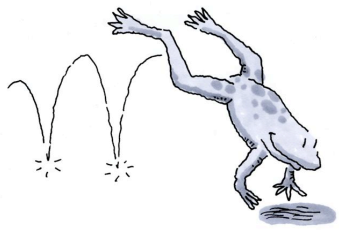
4.2.1 How can I compare the data?

Measures of Central Tendency

You are exposed to a huge amount of information every day in school, in the news, in advertising, and in other places. It helps to have tools to be able to understand what different data mean. In this section, you will turn your attention to what you can learn (and not learn) from data.

4-24. JUMPING FROG JUBILEE

In Chapter 1 you examined results of the Calaveras County Frog Jumping Contest, and saw that the 2009 competition winner jumped 20.5 inches farther than the 2008 winner. Do you think that the winner in 2009 was a special frog? Or were the frogs in 2009 in general better jumpers than the frogs in 2008?



With your team, brainstorm ways that you could compare the two groups of frogs. Recall some of the measures of central tendency from Chapter 1.

2008		**2009**	
Frog Name	**Jump Length**	**Frog Name**	**Jump Length**
Skeeter Eater	231.5 in.	For the Sign	252 in.
Warped	230 in.	Alex Frog	236.5 in.
Greg Crome Dome	229 in.	Shakit	231.5 in.
R.G.	227 in.	Six Mile Shooter	226.75 in.
The Well Ain't Dry	221.5 in.	Spare the Air Everyday	223.25 in.
Winner	220.5 in.	Hooper	223.25 in.
7 lb 8 oz. Baby	217 in.	Jenifer's Jumper	222.25 in.
Delbert Sr.	216.5 in.	Dr. Frog	185.25 in.

a. Look at the 2008 and 2009 data above (or on the Lesson 4.2.1 Resource Page). What was the **range** (the span of smallest and largest values) of the jumps in each year? What does this tell you about the frog jumps?

b. What was the typical jump length of the frogs each year? How did you find this value?

c. Were the jumps all about the same, or were some jumps **outliers** (data that is much higher or lower than the others)? Name any outliers and why you think they are outliers.

d. Describe how the frogs jumped in each year as completely as you can. Was one year's frogs a better group of jumpers than the other? How do you know?

4-25. How can other representations help you analyze the data? Use the Representing Data technology tool (available at www.cpm.org/students/technology) to create histograms of the data from problem 4-24. Set the bin size of each histogram to 10 inches. Then compare the histograms and answer the questions below as a team or class.

a. How does each histogram organize the data? For example, why is the column between 220 and 230 inches for 2008 four units tall? Why is the 2009 column between 230 and 240 two units tall?

b. What new statements can you make based on the histograms that you did not see when the data was in a list? Is there information that is easier to see in the histogram?

c. The technology tool shows the mean and median of the data below the histogram. However, if those were not labeled, is there a way to determine the median or mean from a histogram alone? Explain.

4-26. How does changing the data affect the mean, median, or mode? Use the 2009 data from problem 4-25. For each of the following changes to the data, predict:

- How would the mean of the data change?
- How would the median change?
- How would the mode change?

Be sure to **justify** your prediction. Only after your team has made a prediction should you calculate or use the technology tool to test your idea. Remember to start with the original 2009 data for each part.

a. What if the 9th place jump length for 2009 (which was 182 inches) was included in the data?

b. What if the 8th place jump length for 2009 was 201 inches instead?

c. What if the 1st place frog was disqualified and only the remaining 7 frogs were included in the data?

4-27. Efren has been keeping data on the Calaveras Frog Jumping Contest for several years. Look carefully at the **stem-and-leaf plot** he made for the top 8 jumpers in 2007, shown at right.

2007 Frog Jump Winners
Stem-and-Leaf Plot

Note: 22 | 1 means 221 inches

22	1 2 5 8
23	4 8
24	5
25	6

stem ← → leaf

A **stem-and-leaf plot** displays data by ordering it from least to greatest. All of the digits except the last one form the **stem** (in this case, the tens and hundreds places) and the last digit (in this case the ones) forms the **leaf**. The leaf portion is arranged in order from least to greatest.

a. What is the **minimum** (smallest) value? What is the **maximum** (largest) value?

b. Are there any outliers in the data?

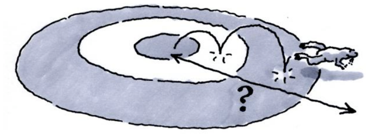
c. Is it possible to find the **median** of the data in the stem-and-leaf plot? If so, find the median. If not, explain why not.

d. Is it possible to find the **mean** with the stem-and-leaf plot? Calculate it and explain what the mean tells you about the frog jumps in 2007.

e. Create a new stem-and-leaf plot for the 2006 data below. Use your plot to identify the **median** and the **mode**.

2006	
Frog Name	**Jump Length**
Clausenn's Cuzor	235 in.
Whipper	222 in.
Me Me Me Me	212 in.
Haren's Heat	212 in.
Midnight Croaker	209 in.
Alex's Hopper	208 in.
Oh Sweet Sue	205 in.
Humpty Jumpty	204 in.

4-28. **Additional Challenge:** A visitor to the frog jumping contest told of another similar contest he attended. He made the statements about the frogs in this contest below. Find a possible set of data that would satisfy all of his statements.



- The measures of the jumps of the seven frogs were all integers and had a median of 14 meters.
- The minimum of the jump data was 11 meters and the maximum was 15 meters.
- The mode of the jump data was 11 meters.

4-29. LEARNING LOG

The mean, median, and mode are each different ways of describing the "center" value of a set of data. You have been finding mean, median, and mode for different data sets since Chapter 1. Describe how to find the mean, median, and mode for a set of data. If a data set includes an outlier, which measure best describes the middle? Title this entry "Measures of Central Tendency" and include today's date.

Review & Preview

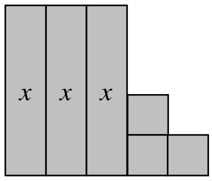
4-30. Mrs. Sakata is correcting math tests. Here are the scores for the first fourteen tests she has corrected: 62, 65, 93, 51, 55, 12, 79, 85, 55, 72, 78, 83, 91, and 76. Which score does not seem to fit in this set of data? How will the outlier score affect the mean of the data? Explain.

4-31. On graph paper, plot the points $A(2,4)$, $B(0,0)$, and $C(6,2)$ to form triangle *ABC*.

a. Multiply the coordinates of each point by 2 and plot the new points. What happened to the triangle?

b. Predict what happens when you multiply each *original point* by $\frac{1}{2}$. Then multiply the coordinates and plot the new points. Was your prediction correct?

4-32. Sketch the algebra tile shape shown at right on your paper. Write expressions for the area and perimeter of the shape. Then, calculate the area and perimeter of the shape for each x-value.



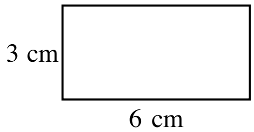
a. $x = 9$ cm

b. $x = 0.5$ cm

c. $x = 15$ cm

4-33. Sophie claims that whenever she increases the perimeter of a rectangle, its area increases.

a. She showed the rectangle at right and said, "*If I make the base twice as long, then the area increases*." Is her statement correct? Draw a diagram of the rectangle she described and explain whether the area is greater or less than the rectangle above.

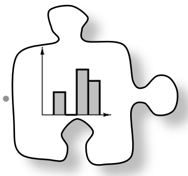


b. Is her claim about the relationship of area and perimeter correct for all figures? For example, is there any way that she could have a rectangle with a greater perimeter but with the same area? Give examples and explain your **reasoning**.

4-34. Evaluate the expression $2x^2 + x + 6$ for the given values of x below.

a. $x = 3$ b. $x = -2$ c. $x = 0$ d. $x = 5$

4.2.2 How can I represent it?



Multiple Representations of Data

Mark Twain, a famous American writer and humorist (1835–1910), once said, "Get your facts first, and then you can distort them as much as you please. (Facts are stubborn, but statistics are more pliable.)" What do you think he meant? Much of what we learn and interpret about different sets of data is based on how it is presented.

In this lesson you will use several mathematical tools to look at data in different ways. As you work, use these questions to help focus your discussions with your team:

What can we conclude based on this representation?

What cannot be concluded based on this representation?

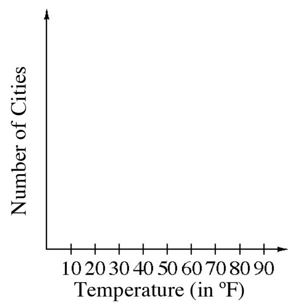
How are the representations related?

4-35. GLOBAL WARMING?

Is the planet getting hotter? Experts look at the temperature of the air and the oceans, the kinds of molecules in the atmosphere, and many other kinds of data to try to determine how the earth is changing. However, sometimes the same data can lead to different conclusions because of how the data is represented.

Your teacher will provide you with some temperature data from November 1, 1975, and November 1, 2000. In all, there is data from 35 cities selected from different parts of the United States. To make sense of this data, you will first need to organize it in a useful way to help some relationship stand out.

a. Your teacher will assign you a city and give you two sticky notes. Label the appropriately colored sticky note with the name of the city on the front and its temperature in 1975 on the back, and label the other sticky note with its city name on the front and temperature in 2000 on the back.



b. Follow the directions of your teacher to place your sticky note on the class histograms. Use the axis at the bottom of the graph to decide into which **bin**, or interval, to place your sticky note.

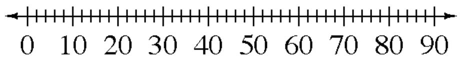
4-36. Look at the graphs of temperatures the class created. According to these histograms, what can you say about the temperatures on November 1 in 1975 and 2000? Do the graphs show that one date was warmer than the other? Or are the temperatures basically the same? Be prepared to share your **reasoning**.

4-37. The histograms your class made in problem 4-35 group data together in different **bins**, that is, intervals along the horizontal axis where data is grouped.

a. What are the benefits of a histogram? What are the limitations?

b. Another way to restructure the data is to form a **box-and-whisker plot**, which divides the data into four equal parts, or **quartiles**. To create one, follow the steps below with the class or in your team:

1. With a sticky dot provided by your teacher, plot the 1975 temperature for your city on a number line in front of the class.



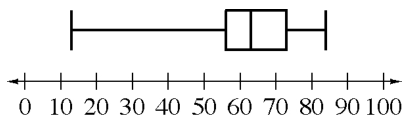
2. What is the median temperature for 1975? Place a vertical line segment — about one-half inch long — marking this position above the number line on your resource page.

3. How far does the data extend from the median? That is, what are the minimum and maximum temperatures in 1975? Place vertical line segments marking these positions above the number line on your resource page.

4. The median splits the data into two sets: those that come before it and those that come after it when the data is ordered from least to greatest, like it is on the number line. Find the median of the lower set (called the **lower quartile**). Mark the lower quartile with a vertical line segment above the number line.

5. Look at the temperatures that come after the median in your ordered number line. The median of this portion of data is called the **upper quartile**. Mark the upper quartile with a vertical line segment above the number line.

6. Draw a box that contains all the data points between the lower and upper quartiles. Your graph should be similar to a "box" with "whiskers" like the one shown at right.



Problem continues on next page. →

4-37. *Problem continued from previous page.*

c. What does the box-and-whisker plot tell you about the temperatures of the cities in 1975 that the histogram did not?

d. With your team, create a new box-and-whisker plot of the temperature data for the same cities on November 1, 2000 on your resource page. Be sure to identify each of the values below.

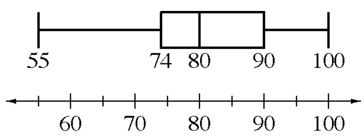
- The minimum and maximum data values (endpoints of the whiskers)
- The median temperature
- The upper and lower quartiles

4-38. Compare the box-and-whisker plots for 1975 and 2000.

a. According to the box-and-whisker plots, how do the temperatures on November 1, 2000 compare to temperatures in 1975?

b. Did your observations about the differences or similarities of the temperatures from 1975 and 2000 change based on the box-and-whisker plots? If so, how and why did they change?

4-39. The box-and-whisker plot at right shows the different grades (in percents) that students in Ms. Drew's class earned on a recent quiz.



a. What was the median score on the quiz? What were the highest and lowest scores?

b. Did most students earn a particular score? How do you know?

c. If Ms. Drew has 32 students in her class, about how many students earned a grade of 80% or higher? About how many earned more than 90%? Explain how you know.

d. Can you tell if the scores between 80% and 90% were closer to 80% or closer to 90%? Explain.

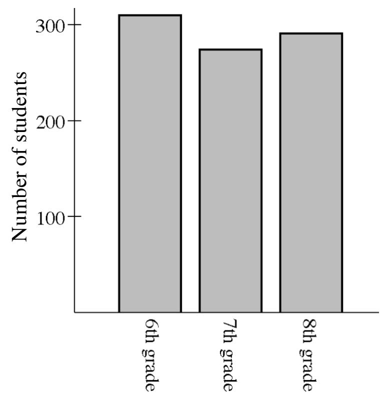
MATH NOTES

METHODS AND MEANINGS

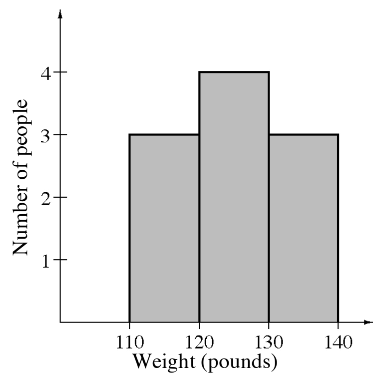
Histograms and Bar Graphs

Data can be displayed visually in different formats depending on the kind of information collected and the purpose for displaying it. Two of those formats are histograms and bar graphs, which look similar but are used in different ways.

A **bar graph** is used to represent discrete quantities—such as the number of eighth graders in your school or the number of people who are wearing blue jeans today. The height of the bar graph shows the frequency (the number of times something occurs) of the data in each category. The quantities are "discrete" because the categories are separate. For example, in the graph at right, a student is either a seventh or an eighth grader; no one is a 7.64th grader. Traditionally, the bars in bar graphs are separated, and each bar has a different label.



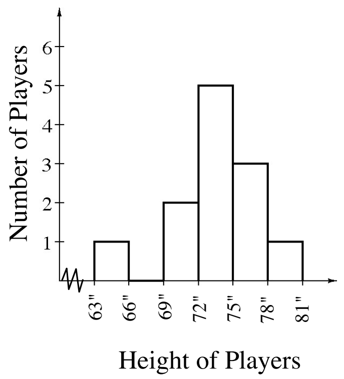
A **histogram**, on the other hand, is a way of representing a collection of data from a continuous set—such people's weight or their distance from home. Each bar represents data in an interval of numbers, called a **bin**. The vertical axis shows the number of pieces of data that fall into a bin (frequency). In the example, the bar on the left shows that there are 3 people in the data set whose weight is from 110 to just below 120 pounds. (Someone who weighs 120 pounds would be counted in the next bin.) For histograms, we label the horizontal axis by the numbers that mark the lower endpoints of each bin.



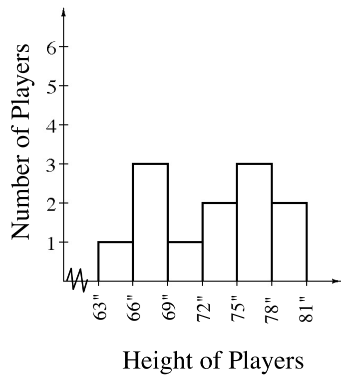
Review & Preview

4-40. Look at the two histograms below. They give you information about the heights of players on two basketball teams, the Tigers and the Panthers. Use the histograms to answer the following questions.

TIGERS



PANTHERS



a. Which team has taller players? Shorter players? Explain your thinking.

b. Which team has heights that vary more? Explain your thinking.

c. Which team has more players that are about the same height?

4-41. Erika is tracking the depth of the water in her local creek. Her first nine measurements are below, in inches:

16 15 13 12 17 14 11 9 11

a. What is the median of her data?

b. Erika's next three measurements are 9 inches, 10 inches, and 9 inches. What is the new median?

4-42. Latisha wants to get at least a B+ in her history class. To do so she needs to have an overall average of at least 86%. So far she has taken three tests and her scores were 90%, 82%, and 81%.

a. Use the 5-D Process to help Latisha determine what percent score she needs on the fourth and last test of the grading period to get the overall grade that she wants.

b. The teacher decided to make the last test worth twice as much a regular test. How does this change the score that Latisha needs on the last test to get an overall average of 86%? Support your answer with mathematical work. You may choose to use the 5-D Process again.

4-43. A lemonade recipe calls for using a ratio of 2 cups of lemon juice for every 4 cups of water.

a. Draw and label a diagram like the one below to show the percent of lemonade that is water and the percent that is lemon juice.

Old-Fashioned Lemonade

b. What is the ratio of lemon juice to total liquid?

c. Angel made 10 cups of lemonade. He used 3 cups of lemon juice in his mixture. Did he follow the same recipe? In other words, did he use the same ratio of lemon juice to total liquid?

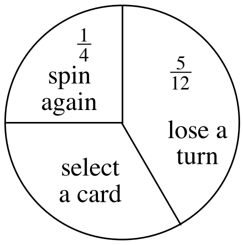
4-44. Use your **reasoning** about numbers to answer the following questions.

a. If multiplying by $\frac{1}{4}$ makes a positive number smaller, then what does dividing by $\frac{1}{4}$ do to the value of the number? Explain your **reasoning**.

b. If multiplying by 1 does not change the value of a number, then what effect does multiplying by $\frac{2}{2}$ have? Explain your **reasoning**.

c. If you find 80% of a number, do you expect the answer to be greater or less than the number? What if you find 120%? Explain your **reasoning**.

4-45. Darnell designed the spinner at right for a game. It still has one incomplete section.



a. Help him figure out the probability of selecting a card on any turn. Show how you got your answer.

b. What is the probability that on any turn you will not get to spin again?

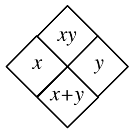
c. Which is more likely: to lose a turn or to select a card? Show how you know.

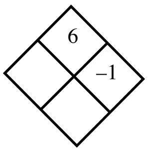
4-46. Elin has made 29 note cards for her friends. She plans to send out a total of 40 cards. What percentage of the cards has she finished? Represent your work clearly on your paper.

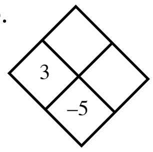
4-47. A triangle has a base that is three times longer than its height. It has an area of 486 sq cm.

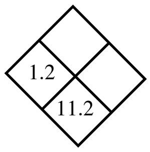
Use the 5-D Process to find the base and height of the triangle. Write a variable expression for each column of your chart.

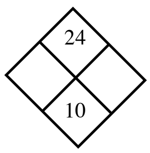
4-48. Copy and complete each of the Diamond Problems below. The pattern used in the Diamond Problems is shown at right.



a.


b.


c.


d.


4.2.3 What happens when the data changes?

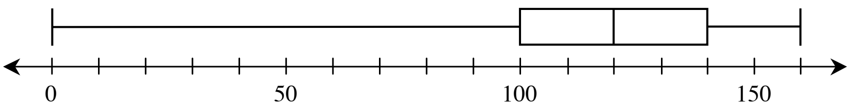
Analyzing Box-and-Whisker Plots

So far in this course, you have considered static (unchanging) sets of data, such as temperatures on a specific date in time or the lengths of leaps of the top performing frog jumpers. However, most of the time, data sets are growing and changing. For example, as you take quizzes or tests in your class, your overall average changes. Similarly, if you decided to track the average temperature on November 1 for each year, then the average you calculate each year would change as you add new pieces of data.

Today, you will explore how each representation changes when the data it describes changes. You will investigate questions like, “What happens if a new piece of data is added?” and “Is there a way to add data without changing the representation?” You can help your study team succeed today by sharing your ideas and your **reasoning** out loud in your team and by working hard to understand other people’s ideas.

4-49. ALDEN’S SODA

Alden created a box-and-whisker plot for the calories in 11 different brands of sodas as shown below.



a. According to this graph, what can you say about the calories of the 11 brands of soda?

b. This is a list of the calories in the sodas represented in the plot:

0, 90, 100, 100, 110, 120, 125, 140, 140, 145, 160

What can you now say about the data (besides the individual values) that you could not say before? Be prepared to **justify** your conclusions.

4-50. Alden found information about three new sodas. The new sodas have 75, 85, and 105 calories in them.

a. Predict how adding the three new pieces of data will change the box-and-whisker plot from problem 4-49.

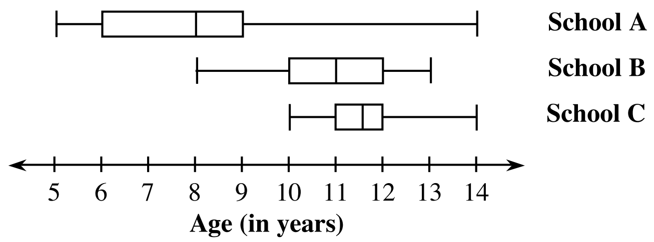
b. Add the new calories to the data in problem 4-49. What are the new median, minimum, maximum, upper quartile, and lower quartile values? Show how you get your answer.

c. On graph paper, make a new box-and-whisker plot that includes the additional sodas. Label each of the important points (listed in part (b)).

d. Compare this box-and-whisker plot to the plot from problem 4-49. How did the first box-and-whisker plot change when you added these three pieces of data?

e. How could you change the data to make the whiskers longer? Shorter? **Justify** your response.

4-51. How do box-and-whisker plots help compare data? Think about this question as you compare the data below that shows the ages of the students at three schools.



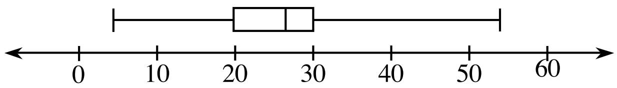
a. Which school is a K-8 school and how do you know? Does that school have more students in K-2, grades 3-5, or 6-8? Why?

b. What does the box-and-whisker plot for School C tell you about 11 year-olds at that school?

c. What statements can you make about School B based on its box-and-whisker plot?

4-52. Levi used the box-and-whisker plot below to say, "*Half of the class walked more than 30 laps at the walk-a-thon.*" Levi also knows that his class has more than 20 students.

Number of Laps per Person



a. Do you agree with him? Explain your **reasoning**. If you do not agree with him, what statement could he say about those who walked more than 30 laps?

b. Levi wants to describe the portion of students who walked between 20 and 30 laps (the box). What statement could he say?

c. How could you alter a single data point and not change the graph? How could you change one data value and only move the median to the right?

4-53. What set of data can you add to any box-and-whisker plot to make one whisker longer, but not change anything else?

4-54. LEARNING LOG

What information can you get from a box-and-whisker plot? Sketch one of the box-and-whisker plots you looked at in this lesson in your Learning Log. Clearly label each number on the plot with the word that describes it. Write one question about the data that you could answer using this plot, and one question about the data that would be impossible to answer. Title this entry, "Box-and-Whisker Plot," and include today's date

4-55. **Additional Challenge:** Find a set of data that has all of these properties:

Mean = 17

Median = 16

Mode = 22

Range = 50

METHODS AND MEANINGS

MATH NOTES

Quartiles

Quartiles are points that divide a data set into four equal parts (and thus, the use of the prefix "quar" as in "quarter"). One of these points is the median, which you learned about in Chapter 1, since it marks the middle of the data set. In addition, there are two other quartiles in the middle of the lower and upper halves: the **lower quartile** and the **upper quartile**.

Suppose you have the data set: 22, 43, 14, 7, 2, 32, 9, 36, and 12.

To find **quartiles**, the data set must be placed in order from smallest to largest. Then divide the data set into two halves by finding the median of the entire data set. Next find the median of the lower and upper halves of the data set. (Note that if there are an odd number of data values, the median is not included in either half of the data set.) See the example below.

2 7 9 12 | 14 | 22 32 36 43

lower half: 2 7 | 9 12 → 8 — **lower quartile** (median of the lower half)

14 → median

upper half: 22 32 | 36 43 → 34 — **upper quartile** (median of the upper half)

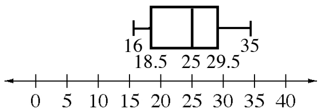
Review & Preview

4-56. Lucy and Marissa each designed a box-and-whisker plot to represent this data set:

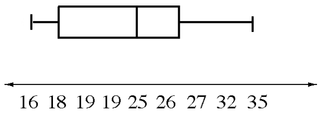
16 18 19 19 25 26 27 32 35

Their plots are shown below. Which plot is scaled correctly and why? Explain the mistakes in the incorrect plot.

a.



b.



4-57. Simplify the expressions below.

a. $7 \cdot 2 + 4 - 2(7 + 3)$

b. $6 \cdot 2 + 3 \cdot 4 - 8$

c. $3^2 + 5(1 - 3) + 4 \cdot 5 + 1$

d. $(8 - 12) + 10 \cdot 3$

4-58. Due to differences in gravity, a 100-pound person on Earth would weigh about 38 pounds on Mars and 17 pounds on the moon.

a. What would a 150-pound person on Earth weigh on Mars? Explain your **reasoning** with words or a diagram.

b. What would a 50-pound person on Earth weigh on the moon? Explain your **reasoning** with words or a diagram.

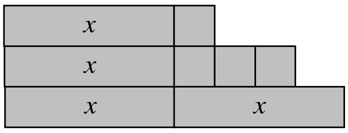
c. **Additional Challenge:** If an astronaut on the moon weighed about 34 pounds, what would that astronaut weigh on Mars? Show how you know.

4-59. Use the 5-D Process to solve the following problem. Write an expression to represent each column of your table.

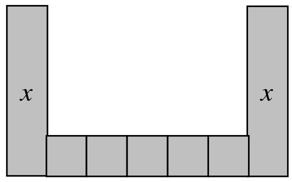
Yosemite Falls, the highest waterfall in the United States, is actually made up of three smaller falls. The Lower Yosemite Falls is 355 feet shorter than the Middle Cascades Falls. The Upper Yosemite Falls is 80 feet more than twice the Middle Cascades Falls. If the entire set of waterfalls is 2425 feet long, how tall is each of the smaller waterfalls?

4-60. Find the perimeter and area of each algebra tile shape below. Be sure to combine like terms.

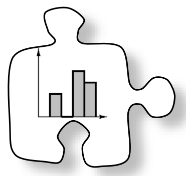
a.



b.



4.2.4 Which representation should I use?



Comparing and Choosing Representations

There are many different representations for displaying data. In this chapter, you have looked at three different representations: histograms, stem-and-leaf plots, and box-and-whisker plots. Today you will compare these representations to decide when one might be a better way to communicate information from a set of data.

4-61. DATA SET DECISIONS

Ms. Anderson's math class has taken a test and she wants to find a good way to display the data from their test scores so that the students understand them.

- Michaela thinks the best representation is a stem-and-leaf plot because it organizes information quickly.
- Gabe thinks Ms. Anderson should use a histogram because it gives a picture that is easier to look at.
- Geri does not agree. She thinks a box-and-whisker plot shows information that the other two representations do not show.

a. Discuss with your team which representation Ms. Anderson should use to display the data. On your paper, **justify** your choice.

b. The test scores for the class are: 78, 62, 91, 51, 55, 93, 76, 82, 65, 85, 79, 83, 55, and 72. On the Lesson 4.2.4 Resource Page, make a stem-and-leaf plot, histogram, and a box-and-whisker plot for this data. Be sure to include a title and labels on all the representations.

4-62. The principal, Mr. Siebers, wants to get information about Ms. Anderson's latest test scores (those listed in problem 4-61). He is interested in the class median, but also wants to know what percentage of students scored lower than a C+ (less than 77 points) on the test.

a. What is the median of the class test scores? Which graph makes this the quickest to see?

b. What percentage of the students scored lower than a C+? Which graph makes this the easiest to see?

4-63. Mrs. Smith, another math teacher, also wants to look at Ms. Anderson's test scores. She wants to see information about how many students earned more than 60 points on the test.

a. Which representation(s) would show her this information? **Justify** your answer.

b. Is your answer to this problem the same as or different from your answer to part (a) of problem 4-62? Why or why not?

4-64. Ms. Anderson still does not know what kind of representation she should use. She knows that each representation shows different kinds of information. Using the representations that you made in problem 4-61:

- List and explain what measures of central tendency or other information will be easily read from each kind of graph listed below.
- List the information that will not be easy to obtain. **Justify** your answers.

a. Histogram

b. Stem-and-leaf plot

c. Box-and-whisker plot

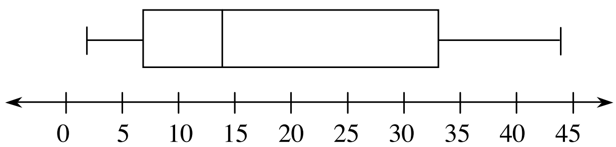
MATH NOTES

METHODS AND MEANINGS

Box-and-Whisker Plots

A **box-and-whisker plot** displays a summary of data using the median, quartiles, and extremes of the data. The box contains "the middle half" of the data. The right whisker represents the top 25% of the data and the left whisker represents the bottom 25% of the data. A box-and-whisker plot makes it easy to see where the data are spread out and where they are concentrated. The larger the box, the more the data are spread out.

To construct a box-and-whisker plot using a number line that shows the range of the data, draw vertical line segments above the median, lower quartile and upper quartile. Then connect the lines from the lower and upper quartiles to form a rectangle. Place a vertical line segment above the number line at the highest and lowest data values. Connect the minimum value to the lower quartile and the maximum value to the upper quartile using horizontal segments. For the data set used in the Quartile Math Note, namely, 2, 7, 9, 12, 14, 22, 32, 36, and 43, the box-and-whisker plot is shown below.



Review & Preview

4-65. Jerome is keeping track of how many books he and his friends have read during the first 100 days of school. Make a stem-and-leaf plot of how many books each person has read to help Jerome present the data to his teacher. The numbers of books are: 12, 17, 10, 24, 18, 31, 17, 21, 20, 14, 30, 9, 25.

a. Make a stem-and-leaf plot of the data.

b. Jerome wants to present the data with a plot that makes it possible to calculate the mean, median, and mode. Can he do this with a stem-and-leaf plot? He is not asking you to calculate them, but he wants you to tell him if it is possible and why.

c. Use the stem-and-leaf plot to describe how the data is spread. That is, is it spread out? Or is it concentrated mostly in a narrow range?

4-66. Copy and simplify the following expressions by combining like terms. Using algebra tiles may be helpful.

a. $3+4x+2+2x+2x$

b. $8x+4-3-x$

c. $7x^2+3x+4+7x^2+3x+4$

d. $5x+4+x+x^2+1$

4-67. Twenty-five percent of the students at Marcus Garvey Middle School bring their lunches from home. 225 students do not bring their lunch. How many students attend the school? Draw and label a diagram to show the number and percent of each group of students.

4-68. Find three fractions that are equivalent to three-eighths. Explain your method.